

53
JOHN WILLIAM WATSON STEPHENS

1865-1946



J. W. W. Stephens.

JOHN WILLIAM WATSON STEPHENS

1865–1946

JOHN WILLIAM WATSON STEPHENS was born at Ferryside, near Carmarthen, on 2 March 1865, the second of three sons of John Stephens, barrister-at-law, and Martha, daughter of Captain David Davies, R.M., Transmawr, Carmarthen-shire. The family was an old Carmarthenshire one with many branches living in the neighbourhood, and Stephens after retirement lived and died in the house in which he was born. His early boyhood was spent at Ferryside where he went to a small preparatory school. Later he was sent for a term to Christ's College, Brecon, and then to Dulwich College, where he distinguished himself by winning prizes in successive years for mathematics and Greek in 1879, chemistry 1880–1882, as also two prizes in this subject in 1883, together with one in physics and one in physiology in the same year. Having decided to embark on a medical career, he entered Gonville and Caius College, Cambridge, in October 1884, taking his B.A. and Natural Science Tripos in 1887. He received his medical education at St Bartholomew's Hospital, taking his M.B., B.C. in 1893, followed by the D.P.H. in 1894. After qualifying he continued to work during 1895 and 1896 at St Bartholomew's as Sir Trevor Lawrence Research Student in Pathology and Bacteriology, publishing several papers on bacteriological subjects. He was President of the Abernethian Society in 1896. His main recreation at this time was Rugby football and he played forward for Barts when they won the Hospital Cup. He also played at times for Carmarthen. In 1896–1897 he continued to work on pathology at Cambridge as John Lucas Walker Student in Pathology under A. A. Kanthack, then Professor of Pathology, Cambridge University. He used frequently to refer to Kanthack for whom he evidently had a high respect and affection, and whose influence in turning his attention to research he often acknowledged. At this time he was greatly interested in the study of snake venoms and on the testing of the isotonic point, now usually referred to as the fragility test, of the red blood corpuscles, a technique he later applied to the investigation of blackwater fever.

On termination of his scholarship at Cambridge Stephens was recommended by Kanthack for a post then vacant at Muktesar in India, and in 1897 he sailed for India with the status of Assistant Bacteriologist to the Government of India. Muktesar, a hill station in the Himalayas, was the headquarters laboratory of the Veterinary Department and was then under Professor Lingard. From remarks later made by Stephens to the writer concerning this time the impression was gathered that the conditions were not congenial and Stephens resigned the appointment in 1898. It was whilst on his way from Muktesar, when breaking journey to stay with some friends at Naini Tal, that he first

met his future wife to whom he was married on a second visit to India as noted later. In this year (1898) he obtained his M.D.(Cantab.), his thesis being entitled 'On the haemolytic actions of snake toxins and toxic sera'.

On his return to England Stephens in the summer of 1898 was appointed a member of the Malaria Commission of the Royal Society and Colonial Office, a Commission instigated by that far-sighted statesman, Sir Joseph Chamberlain, then taking a deep interest in the welfare of the colonies. It was through this same influence that, a little later, the Liverpool and then the London School of Tropical Medicine were founded, the latter under Manson, the former, with which Stephens was later to be so intimately connected, the result of the insight and initiative of Sir Rubert Boyce, then Professor of Pathology, Liverpool University. The Commission was composed of three members, two, Stephens and Christophers (the names were later so linked in many joint writings on malaria) appointed by the Royal Society and Dr C. W. Daniels, Colonial Medical Service, representing the Colonial Office. Stephens and Christophers before proceeding to British Central Africa (now Nyasaland Protectorate) spent a month or so in Italy visiting Golgi's clinic at Pavia and working for a time at the San Spirito Hospital, Rome. The experience so gained was later to be of very great value as at this time little was known in this country regarding blood parasites and the techniques for observing these. Indeed it was only then for the very first time that these observers saw such a parasite as a trypanosome or any of the now familiar intracellular parasites of birds and other vertebrates. British Central Africa was selected largely at the instance of the African Lakes Corporation who had large interests in the country and were then gravely concerned at the high incidence of blackwater fever among their personnel. They provided every facility for the Commission's work and much kind hospitality. Almost inevitably it was blackwater fever which chiefly engaged the Commission's attention during the year or so spent here. Efforts to find the supposed 'piroplasma-like' causative organism, then the favoured theory, were unavailing and even at this early stage it became evident that this dread disease, though not an attack of malaria, was the result of malaria. Stephens in particular became deeply absorbed in efforts to unravel the mystery of this disease, an absorption which characteristically was to continue up to the time many years later when he summarized everything that was known about it in his book *Blackwater fever*, published in 1937. Cases were, however, mostly at out-stations often necessitating journeys of forty miles or so to reach. Further, conditions were not, or so it was thought, favourable to the study of mosquito transmission. On representations made by Stephens the Commission, after a year spent at Blantyre, obtained permission to change their location to the West Coast. Daniels, who after some months spent with Ross at Calcutta had joined the other members at Blantyre, however, remained and later travelled extensively through parts of east and central Africa. At Sierra Leone and then on the Gold Coast results came thick and fast. The outstanding discovery, now accepted as obvious, though it was not so at the time, was the role played by the native, and especially the native child, in the malaria of Europeans. It was character-

istic of early views on how Europeans contracted malaria that before realizing the true state of affairs the Commission at one railway camp made a serious attempt to trace out among Europeans in the camp case-to-case transmission, an attempt which naturally failed, since the infection was not being derived from 'cases' of malaria but from the apparently healthy children in the servants and coolie lines. Later the whole rationale of European infection and in general the 'new epidemiology' of malaria in the tropics became broadly mapped out, not very different to the present state of our knowledge. These findings, with the somewhat similar observations by Koch in the New Guinea area, were the first in which it was ever suspected that the natives of a malarious country, though seemingly healthy, might be, and commonly were, all infected. They were the first in which conceptions of endemicity in malaria as now understood were set out and the first in which the principle of segregation of the susceptible stranger from indigenous infection was laid down as a major anti-malaria measure in the tropics. The conditions under which the Commission worked were very primitive. Their best material was found at the small temporary camps on lines of railway then under construction from the coast into the interior. At these they lived in clearings in the bush in two small tents, with one for their boys, doing laboratory work and having their meals on the same two camp tables, shooting pigeons or other game to eke out rations. In one such camp the sporozoite rate was 50 per cent. Yet neither worker in the whole of a year spent under such conditions contracted malaria, a result undoubtedly due to the extreme care employed in the use of the mosquito net and other protective measures. It was at this time that on one occasion, travelling down coast by steamer from Freetown, the Commission by chance found themselves on the same boat as were Drs Annett and Dutton proceeding to Nigeria on one of the first expeditions from the Liverpool School—a very pleasant experience.

On the succeeding year at the request of the Indian Government the Commission visited India. Following upon the African experience the conditions in India were extraordinarily different. In place of primitive conditions of work and travel here were all the amenities of civilization, soda water, ice, comfortable travelling, an indescribable variety of sights and experiences. In this case Stephens travelled out ahead to India and at Meerut on 16 April 1901 married Mary Sophie, daughter of Lieutenant-Colonel E. C. C. Sandys, whom, as previously noted, he had first met at Naini Tal in 1898. Leaving Mrs Stephens at Meerut, Stephens then rejoined Christophers at Calcutta, where also Capt. S. P. James, I.M.S., who had been placed on special duty with the Commission by the Government of India, shortly afterwards arrived. At Calcutta, and later in the Bengal Duars, many new facts about malaria were elicited, perhaps the most important being that different species of anopheles were very selective in their choice of breeding place, the basis of the modern idea of 'species sanitation'. From Calcutta the Commission moved to Lahore with a view to initiating the experimental anti-malaria operations at Mian Mir. Here Mrs Stephens and Mrs James rejoined their husbands and of the many experiences in India that stand out in memory the months spent at this time were among the pleasantest.

Later when the cold weather made the Punjab unsuitable for further observations Stephens and the writer visited the Jeypore Hill Tracts where cases of blackwater fever had been reported. They travelled by bullock cart, the recognized mode of travel then in such areas, and examined many villages in this typically hyperendemic tract, later surveyed in great detail by Perry (1914). In the spring the Commission reassembled at Lahore, but Stephens had now for some time been suffering from dysentery, and in April 1902 he and Mrs Stephens returned to England.

The visit of the Commission to India, quite apart from its direct scientific results, had a great effect upon the future course of malaria work in that country. Techniques of blood examination and mosquito dissection and other procedures in malaria work were made widely known, the use of the spleen rate and parasite rate in mapping malaria was introduced and in general interest was aroused in the study of this disease. The results of the Commission were embodied in some eight reports to the Malaria Committee of the Royal Society published between 1900 and 1903. Mention may also be made of the book, *Practical study of malaria*, by Stephens and Christophers, to which many beginners at this time turned for the only available practical help in their studies. It saw three editions, the last in 1908, when pressure of work, separation of the authors and rapid advances in knowledge made any further edition impracticable.

After more than three years spent in travelling in various tropical countries Stephens was now anxious to obtain some suitable post at home. At this time Sir Rubert Boyce was actively engaged in creating the Liverpool School of Tropical Medicine and desirous of obtaining staff of the highest possible attainments. The result was that Stephens was appointed Walter Myers Lecturer in Tropical Medicine at Liverpool, a post which he held until on retirement of Sir Ronald Ross in 1913 he was appointed Alfred Jones Professor of Tropical Medicine, Liverpool University, and at the same time Physician in Charge Tropical Wards, Liverpool Royal Infirmary, both of which positions he held for some fifteen years until his retirement in 1928.

During these fifteen years Stephens contributed greatly to knowledge of tropical medicine and parasitology. Even before this, whilst carrying out in collaboration with Fantham the translation and preparation of the English edition of Braun's great work, *Die tierischen Parasiten des Menschen*, he had described two new human cestodes, a new linguatulid, a new human nematode and a new species and genus of monostome flukes. In 1910 Stephens discovered, and with Fantham described, *Trypanosoma rhodesiense*, a hitherto unrecognized trypanosome of man and the cause of sleeping sickness in South-East Africa. This discovery was typical of Stephen's critical and curiously acute and deliberate powers of observation. The discovery was made whilst he was examining in class work a stained specimen of rat's blood infected with what was supposed to be *T. gambiense*, the only recognized form of human trypanosome at that time. He noted a marked peculiarity in the morphology and after tracing the case, one of sleeping sickness in Professor Ross's clinic at the Royal Southern Hospital infected in Rhodesia, and inoculating fresh rats which showed the

same peculiarities, he worked out with Fantham the characters of this new form and named it. *T. rhodesiense* is now a well recognized species responsible for sleeping sickness in Rhodesia and south of Lake Nyasa. Its pathogenicity in different animals has been worked out by Yorke. It is transmitted by *Glossina morsitans*, not *G. palpalis* which does not occur in the region in question.

In 1922 Stephens described a new malaria parasite of man, *Plasmodium ovale* Stephens, the only human malaria parasite over and above the three classical species that has been universally accepted as a valid species. This was a parasite found in the blood of a soldier returned from East Africa which showed features similar to some half-dozen previously seen where difficulty arose in diagnosis as between simple tertian and quartan. Large forms of the parasite showed a complete absence of the straggling processes seen in simple tertian and at the same time lacked the characteristic features of quartan as well as having a tertian periodicity. Careful examination showed that the smaller forms were also peculiar in affecting the red cell in a particular way. Since its characters seemed to be different to those of any of the three known forms of parasite, Stephens named it *P. ovale*. A very detailed account was later given of this parasite by James, Nicoll and Shute (1932, 1933) who confirmed Stephens's description and contention that it was a distinct species. These authors were able to transmit infection through *Anopheles maculipennis*, the morphological features being preserved from patient to patient. Many other workers have since described this form which is now firmly established as a fourth species of human malaria parasite. The parasite appears to be commonest in East Africa, but has been authentically reported from many parts of the world. A peculiarity is that, as shown by Sinton *et al* (1942), the degree of immunity which an attack confers is very great so that it is seen only in the children of indigenous races where it occurs or in such occasional Europeans as contract infection. Stephens has described still another form of new human malaria parasite, viz., *P. tenue*, which, however, has not been generally accepted as distinct. *P. tenue* was described from the blood of a native child from Central India and is characterized by the extreme amoeboid shapes of the young trophozoite. There are in the writer's opinion (Christophers (1924)), other features characterizing this form, which, if distinct, is very common in the semi-aboriginal races of Central India.

With the onset of the 1914–1918 war many burning questions arose regarding the use of drugs in the treatment of malaria. This led to the whole subject being investigated by a team of workers at Liverpool, with Stephens at their head, whose work remains one of the most important ever undertaken on the action of quinine in the treatment of malaria. The results were published in some thirty papers appearing in the *Annals* in 1917–1919. The authors investigated systematically the relative efficacy of oral, intravenous and intramuscular administration of the alkaloid and various salts of quinine on each of the three species of parasite, as also the effect of single, interrupted, prolonged and massive doses of this drug. It would be no exaggeration to say that this work once and for all disposed of the idea that malarial infection, at least with the benign

tertian parasite, could be eliminated by the use of either prolonged or heroic doses of quinine and thus marked the beginning of the modern type of treatment where no attempt is made, as was formerly done, to eradicate infection by such means.

But whilst these and other researches have at various times been undertaken by Stephens, his main preoccupation extending over nearly four decades has been blackwater fever. For from the time he became intrigued with the nature of blackwater fever whilst on the Malaria Commission in 1900 until the publication of his book summarizing all that was known of the disease in 1937 he never gave up his preoccupation with that subject, and during the five years or so before the book's publication, when he was exhaustively studying the literature, thoughts about blackwater fever dominated all else. Few diseases are more important to the European in tropical malarious regions than blackwater fever for it is in this guise chiefly that malaria in such a case kills, and it is blackwater fever which has been mainly responsible for the evil reputation gained by the West Coast of Africa. Unfortunately it is a disease that has not so far yielded results comparable with the amount of research expended upon it, and whilst its study has always resulted in more and more evidence of its dependence on malaria, and under certain circumstances its precipitation by quinine, of its fundamental nature we are still quite ignorant. How far it is, except in a certain class of case, dependent on quinine has never been clearly shown. Stephens investigated this point intensively and was able to enlist the help of the Colonial Medical Department in so far that a questionnaire was circulated to all medical officers in that service. Unfortunately study of the mass of data supplied left the issue still undecided. Whatever evidence there was, however, Stephens with painstaking thoroughness has collected, exhaustively studied and published. Another feature of blackwater fever, viz., its geographical distribution has similarly been dealt with in a most detailed and complete manner. Two papers respectively on the functions of the spleen and on the haemoglobinurias, both subjects which have an important bearing in relation to blackwater fever, are remarkable examples of the thoroughness with which Stephens approached any subject he took up.

During his time at Liverpool Stephens visited Egypt in November 1909 in connexion with his helminthological work at that time. In 1921 he accepted the invitation of the Venezuela Company to visit and report upon the conditions relative to malaria on the oil-fields at Maracaibo. Three months were spent in the hottest season of the year in this survey. At the 7th Congress of the Far Eastern Association of Tropical Medicine held at Calcutta in December 1927, Stephens represented the Liverpool School of Tropical Medicine. He was amongst those invited to the important United Fruit Company's Congress held at Kingston, Jamaica, in 1924.

On his retirement Stephens left Hoylake, where he had been living during his professorship, for Ferryside, near Carmarthen, and the house 'Holcwm' where he was born, in a part of Wales which had for him many associations. From here he and Mrs Stephens usually came for a few months in the winter

to a flat in the neighbourhood of South Kensington and very pleasant and peaceful were the Sunday afternoons which the writer and his wife and Professor and Mrs Stephens spent in Kew Gardens wandering among shrubs and conifers or whatever part of the gardens seemed at the time most attractive. But with the onset of the war these visits ceased, and having completed his book on blackwater fever Stephens became more and more wedded to a life in the country.

No account of Stephens's life would be complete which did not in some degree make clear his curious devotion to his Welsh home. His interests here were many and varied, bird life, his garden, the local traditions were all sources of interest and pleasure to him. Mixing with the villagers, fishermen and local farmers, from whom he picked up interesting or amusing information was always a great happiness to him. A simple-hearted, kindly man with a keen sense of humour, he was beloved and respected by all. He had always been interested in local landmarks, stories of sunken lands, changes in the coast line and such-like matters, and he now began to investigate these more systematically. As time went on his studies became more definite and precise. Ancient documents were hunted up, the names and histories of fields ascertained and papers written on specific subjects. In all, apart from writings to *The Welshman* and other possible short articles, he has published four papers on local archaeological matters, viz., 'Historical notes on the church of St Ismael, Carmarthen-shire' (*Trans. Carm. Antiq. Soc.*, 1939); 'Where was Alken Church? Parish of St Ismael, Co. of Carmarthen' (*Arch. Camb.*, Dec. 1937 and June 1939); and 'The identity of Alken Church and Llansaint' (*Trans. Carm. Antiq. Soc.*, 1939). Whilst at Liverpool Stephens and Professor Newstead, F.R.S., were on very friendly terms and an occasional visit from this old friend, who since his retirement had become an authority on Roman Britain and the excavation of Roman sites, was a pleasure which Stephens often referred to.

The following is an appreciation of Stephen's archaeological work kindly given to me by Sir William Ll. Davies of the National Library of Wales, where notes and manuscripts left by Stephens are being preserved.

'During his retirement at Ferryside he applied his scientific training to the elucidation of problems in local history. He devoted much time and energy to the study of the history of the lordship of Kidwelly and its members. He has left files of notes for the compilation of histories of Kidwelly, Llansaint, St Ismael and Ferryside, and on place-names and antiquities mainly of the land lying east of the Towy estuary. Some of the notes were published in the *Transactions of the Carmarthenshire Antiquarian Society* and in *Archaeologia Cambrensis*. Of his published work the most important was his identification, with conclusive proofs, of Alkenchurch with Llansaint.'

Observation of bird life was another subject in which Stephens, not only during his retirement, but for so long as the writer has known him, was deeply interested. This was one of his greatest pleasures as a relaxation during his professorship at Liverpool, for at Hoylake on the Wirral coast, where he lived at this time, are great stretches of sand uncovered at low tide with Hilbre

Island and the estuary of the Dee not far away, and here Stephens would wander with powerful glasses observing the many forms of sea-bird life which frequented these parts. At Ferryside after his retirement bird observation was one of his greatest pleasures, and especially so when he could make expeditions to the islands of Grassholme and Skomer off the coast of Pembrokeshire, or to Worms Head on the Gower Peninsula, or nearer home to a delightful little coast lagoon known as the Witchett, near the Pendine sands. Apart from an occasional article in papers or journals it is not known that he ever published on this subject, but characteristically he made a serious study of it and was deeply versed in scientific literature on birds.

Whilst living at Ferryside he was indefatigable too in care of his garden at Holcwm, taking special interest in shrubs and conifers. In a curiously unhastened way he had also been reading and experimenting with the subject of sun-dials and the mathematics of projection this involved. Holcwm is situated on a steep spur of high ground and the garden is in a series of steep terraces. High up on the uppermost terrace with a wide view over the Towy estuary to the old ruined castle of Llanstephan is a little plot of well-kept lawn with a sundial in its centre, and to one side some special conifers, one a specimen of *Juniperus communis* var. *compressa*, a perfect, untouched, smooth spear of green. The spot seemed to symbolize something of the simple heart of its late owner.

During the last few years increasing age restricted many of his former activities and latterly he failed rapidly. He died at Holcwm on 17 May 1946, aged eighty-one, leaving a widow and two sons, John and David Stephens.

During his life Stephens received many honours. He was Kingsley Memorial Medallist, Chester Society of Natural Science, Literature and Art, 1918. He was elected Fellow of the Royal Society in 1920. He was Membre d'Honneur de la Societe Belge de Medicine Tropicale, 1923; Mary Kingsley Medallist, Liverpool School of Tropical Medicine, 1929; Manson Medallist, Royal Society of Tropical Medicine and Hygiene, 1935, and Membre d'Honneur de la Société de Pathologie Exotique, 1936. During the 1914–1918 war he was commissioned Lieutenant-Colonel R.A.M.C. and was Consultant in Malaria, Scottish, Northern and Western Command. On his retirement from his professorship in Liverpool he was made Emeritus Professor by the University. He was President of the Royal Society of Tropical Medicine and Hygiene, 1927–1929. He was a member of the Colonial Medical Research Committee appointed by the Secretary of State for the Colonies in 1927.

Among the many tributes to his memory is that expressed in a letter conveying to his widow the following expression of sympathy from the Council of the Royal Society of Tropical Medicine and Hygiene: 'At the meeting of our Council last week there were many references to Professor Stephens, by whose passing the Society has lost one of its very distinguished and well-loved Fellows who has served on the Council for many years and as President from 1927–1929. Professor Stephens's many important and valuable contributions to Tropical Medicine have brought international renown and his name will always be associated with advance in the study of malaria and blackwater fever'. And

Professor Newstead in his obituary notice in the *Chester Chronicle* for 25 May 1946 says of Stephens: 'He had an extraordinary flair for detecting the salient morphological character of the most minute organisms, which made him one of the greatest parasitologists of his day'.

Stephens was not only a worker in science. He had the wide interest, the critical spirit and the desire for fundamental truth of the true scientist. Whilst he had his own fields of special interest he was ready to be interested in almost any subject. This was not merely polite deference to the person he might be with, but a real readiness to perceive the interest, a fact which made him a very pleasant companion. As shown in his research work he had an intensely critical mind, was without bias and exhibited a pertinacity in following up any subject he was interested in—that was one of his greatest characteristics. As an example of this pertinacity was his attempt to trace some human bones that many years ago had been taken from a tumulus in the neighbourhood of Ferry-side and were said to have been sent to some collection in London. Stephens year after year on his visits to London attempted to find what had happened to them, making enquiries, writing and visiting various anatomical and other museums and only when every possible line of investigation had been followed up did he cease to pursue the enquiry. At one time he devoted a good deal of attention to the logical presentation of subject matter, worrying at some form of statement until it could be put in syllogistic form—often with unexpected result. Some of his published criticisms of medical statements and statistics in this respect have been very trenchant.

He was extraordinarily widely read, not only in science, but especially when younger, in general literature. At his home this was to be seen in the range of subject covered by the books he had accumulated, most of them bearing marginal notes showing that they had been closely and critically studied. In later life, however, this was mainly in scientific subjects and related to his interest in birds, shrubs, gardening, etc., even so a wide and catholic field. His attitude to archaeological research was rather unusual. It was as if he brought his mind in rapport with his surroundings and allowed these to build up without hurry or urgency their own history by the accumulation of the facts. As in his parasitological researches he had a mind critical far beyond the usual and imaginings were far removed from his methods.

As a man Stephens was rather retiring and reserved, though less so as he grew older, and he was never willing to push himself forward or make claims for his own work and this diffidence probably somewhat lessened the credit and prestige he might have had. Above all he was utterly incapable of any meanness of outlook and in a long acquaintance the writer has never heard him belittle or disparage the work of others. He was indeed a man with a simple, direct nature with high intellectual endowments, more concerned with scientific interests than social or worldly matters, a lover of simple country life and quiet pursuits, but one who by his powers of work and critical observation has made himself a reputation as one of the foremost medical scientists of his day.

S. R. CHRISTOPHERS

BIBLIOGRAPHY

1896. (With R. F. W. SMITH.) *Vibrio tonsillaris* (Klein), beschreibung eines aus der Mundhöhle isolierten vibrios. *Cent. f. Bakt.* I Abt. 19, 929–932.
1896. (With A. A. KANTHACK.) The escape of the diphtheria bacillus into the blood and organs. *Trans. Path. Soc. London*, 47, 361–371. Abstract in *Brit. Med. J.* (25 January), 212; *Lancet* (25 January), 231.
1896. (With A. A. KANTHACK.) A new and easy method of preparing serum agar-agar: an aid to the diagnosis of diphtheria. *Lancet* (28 March), 835.
1896. (With A. A. KANTHACK.) Ein neues und bequemes Verfahren zur Bereitung von serum agar-agar als Hilfsmittel zur Erkennung der Diphtherie. *Cent. f. Bakt.* I Abt. 9, 321.
- 1896–1897. (With C. D. PARFITT.) Three cases of haemorrhagic diphtheria. *J. Path. and Bact.* 4, 424–428; *Trans. Path. Soc. London*, 48, 265–271.
- 1897–1898. (With W. MYERS.) The action of cobra poison on the blood: a contribution to the study of passive immunity. *J. Path. and Bact.* 5, 279–301; *Trans. Path. Soc. London*, 49, 352–367.
1898. (With W. MYERS.) The influence of cobra poison on the clotting of blood and the action of Calmette's anti-venomous serum upon the phenomenon. *Proc. Physiol. Soc.*, in *J. Physiol.* 23, 1.
1898. Van Ermengem's method of staining flagella: a modification. *Lancet* (1 October), 874.
1900. (With S. R. CHRISTOPHERS.) The malarial and blackwater fevers of British Central Africa. *Repts. Malaria Comm. Roy. Soc.* Ser. I. 12–41.
1900. (With S. R. CHRISTOPHERS.) The distribution of *Anopheles* in Sierra Leone. *Repts. Malaria Comm. Roy. Soc.* Ser. I. 42–75.
1900. (With S. R. CHRISTOPHERS.) The native as the prime agent in the malarial infection of Europeans. *Repts. Malaria Comm. Roy. Soc.* Ser. 2. 3–19.
1900. (With S. R. CHRISTOPHERS.) Note on certain bodies found in the glands of two species of *Culex*. *Repts. Malaria Comm. Roy. Soc.* Ser. 2. 20.
1900. (With S. R. CHRISTOPHERS.) The malaria of expeditionary forces and the means of its prevention. *Repts. Malaria Comm. Roy. Soc.* Ser. 2. 20–22.
1900. (With S. R. CHRISTOPHERS.) The agglutination of sporozoites. *Repts. Malaria Comm. Roy. Soc.* Ser. 3. 1.
1900. (With S. R. CHRISTOPHERS.) The malarial infection of native children. *Repts. Malaria Comm. Roy. Soc.* Ser. 3. 2–13.
1900. (With S. R. CHRISTOPHERS.) The destruction of *Anopheles* in Lagos. *Repts. Malaria Comm. Roy. Soc.* Ser. 3. 14–19.
1900. (With S. R. CHRISTOPHERS.) Note on malarial fever on railways under construction. *Repts. Malaria Comm. Roy. Soc.* Ser. 3. 20.
1900. (With S. R. CHRISTOPHERS.) The segregation of Europeans. *Repts. Malaria Comm. Roy. Soc.* Ser. 3. 21–24.
1900. (With S. R. CHRISTOPHERS.) Blackwater fever and malaria. *Brit. Med. J.* 2, 1406–1407.
1901. (With S. R. CHRISTOPHERS.) Proposed site for European residences in the Free-town Hills. *Repts. Malaria Comm. Roy. Soc.* Ser. 5. 1–4.
1901. (With S. R. CHRISTOPHERS.) Mononuclear leucocytes diagnostic of malaria. *Repts. Malaria Comm. Roy. Soc.* Ser. 5. 5–6.
1901. (With S. R. CHRISTOPHERS.) Malarial fever without parasites. *Repts. Malaria Comm. Roy. Soc.* Ser. 5. 7–9.
1901. (With S. R. CHRISTOPHERS.) Tonicity of blood in Malaria and blackwater fever. *Repts. Malaria Comm. Roy. Soc.* Ser. 5. 10–11.
1901. (With S. R. CHRISTOPHERS.) Blackwater fever: summary and conclusions. *Repts. Malaria Comm. Roy. Soc.* Ser. 5. 12–27.
1901. Blackwater fever. *Lancet* (23 March), 848.

1902. (With S. R. CHRISTOPHERS.) Relation of malarial endemicity to 'species' of Anopheles. *Repts. Malaria Comm. Roy. Soc.* Ser. 6. 3-10.
1902. (With S. R. CHRISTOPHERS.) Some points in the biology of the species of Anopheles found in Bengal. *Repts. Malaria Comm. Roy. Soc.* Ser. 6. 11-19.
1902. (With S. R. CHRISTOPHERS.) Relation between enlarged spleen and parasitic infection. *Repts. Malaria Comm. Roy. Soc.* Ser. 6. 20-23.
1902. (With S. R. CHRISTOPHERS.) The classification of Indian Anopheles into natural groups. *Repts. Malaria Comm. Roy. Soc.* Ser. 7. 3-14.
1902. (With S. R. CHRISTOPHERS.) The relation of species of Anopheles to malarial endemicity. *Repts. Malaria Comm. Roy. Soc.* Ser. 7. 15-22.
1902. (With S. R. CHRISTOPHERS.) An investigation into the factors that determine malarial endemicity. *Repts. Malaria Comm. Roy. Soc.* Ser. 7. 23-44.
1902. (With S. R. CHRISTOPHERS.) Note on bodies in the salivary glands of Anopheles, etc. *Repts. Malaria Comm. Roy. Soc.* Ser. 7. 45-46.
- 1902-1903. Native malaria and malarial prophylaxis. *Climate* (London), 4, 273-283.
1903. (With S. R. CHRISTOPHERS.) The occurrence of blackwater fever in India. *Repts. Malaria Comm. Roy. Soc.* Ser. 8. 1-2.
1903. (With S. R. CHRISTOPHERS.) Malaria in an Indian Cantonment (Mian Mir). *Repts. Malaria Comm. Roy. Soc.* Ser. 8. 3-21.
1903. (With S. R. CHRISTOPHERS.) Brief summary of conclusions arrived at in previous papers. *Repts. Malaria Comm. Roy. Soc.* Ser. 8. 22-26.
1903. (With R. BOYLE.) A parasitic disease in the haddock. *Thomson Yates and Johnston Lab. Repts.* 5 (part 2), 105-107.
1903. Note on the staining of bacterial flagella with silver. *Thomson Yates and Johnston Lab. Repts.* 5 (part 1), 121-122.
1903. Blackwater fever. *Thomson Yates and Johnston Lab. Repts.* 5 (part 1), 193-218.
1903. (With S. R. CHRISTOPHERS.) Summary of researches on native malaria and malarial prophylaxis. *Thomson Yates and Johnston Lab. Repts.* 5 (part 1), 221-233.
1903. (With S. R. CHRISTOPHERS.) Note on the changes in the red cell produced by the malignant tertian parasite. *Brit. Med. J.* (28 March), 730.
1903. (With S. R. CHRISTOPHERS.) *The practical study of malaria and other blood parasites*. London: Longmans Green and Co.
1903. The nomenclature of trypanosomes (Letter). *Lancet*, 5 (December), 1615.
1904. The anti-malarial operations at Mian Mir. *Lancet*, 5 (March), 637-638.
1904. On non-flagellate typhoid bacilli. *Lancet* (2 July).
1904. The prophylaxis of malaria. *Lancet* (27 August), 611.
1904. (With S. R. CHRISTOPHERS.) *Practical study of malaria*. 2nd ed. London: Longmans Green & Co.
1905. A new haemogregarine in an African toad. *Thomson Yates and Johnston Lab. Repts.* 6 (part 1), 115-117.
1905. Two cases of intestinal myiasis. *Thomson Yates and Johnston Lab. Repts.* 6 (part 1), 119-121.
1905. Note on the pathology of tropical swellings. *Thomson Yates and Johnston Lab. Repts.* 6 (part 1), 123-124.
1905. Non-flagellate typhoid bacilli. *Thomson Yates and Johnston Lab. Repts.* 6 (part 1), 125-126.
1906. Note on the anatomy of gastrodiscus (Lewis and McConnel, 1876). *Thomson Yates and Johnston Lab. Repts.* 7, 9-12.
1906. A note on the structure of *Spirochaeta duttoni*. *Lancet* (18 August).
1906. (With S. R. CHRISTOPHERS.) *Etude pratique du paludisme et des parasites du sang*. Trans. from the English by Ed. and Et. Sergent. Doin. Paris.
1906. (With R. NEWSTEAD.) The anatomy of the proboscis of biting flies. *Liverp. Sch. Trop. Med. Mem.* 18, 51-74.
1907. (With R. NEWSTEAD.) The anatomy of the proboscis of biting flies. II. Stomoxys. *Ann. Trop. Med. Parasit.* 1, 169-198.

1908. (With S. R. CHRISTOPHERS.) *Practical study of malaria*. 3rd ed. Liverpool.
1908. Two new human cestodes and a new linguatulid. *Ann. Trop. Med. Parasit.* 1, 549–556.
1908. Fevers in the tropics. *Med. Chronicle* (November).
1909. A new human nematode, *Strongylus gibsoni*. n. sp. *Ann. Trop. Med. Parasit.* 2, 315–316.
1909. On the supposed occurrence of *Filaria immitis* in man. *Ann. Trop. Med. Parasit.* 2, 317–319.
1909. Observations on the hooklets of *Cysticercus cellulosae* in man. *Ann. Trop. Med. Parasit.* 2, 391–395.
1910. (With H. B. FANTHAM.) On the peculiar morphology of a trypanosome from a case of sleeping sickness and the possibility of its being a new species (*T. rhodesiense*). *Proc. Roy. Soc. B.* 83, 28–36; *Ann. Trop. Med. Parasit.* 4, 343–350.
1911. The anti-malarial operations at Ismailia. *Ann. Trop. Med. Parasit.* 5, 215–231.
1911. Methods for detecting sporozoites and zygotes in mosquitoes infected with malaria. *Bull. Ent. Res.* 2, 1–8.
1911. Discussion on yellow fever on the West Coast of Africa. *Yellow Fever Bureau Bull.* 1, 267–273.
1911. *Desmogonius desmogonius*, a new species and genus of monostome flukes. *Ann. Trop. Med. Parasit.* 5, 497–500.
1912. *Paropisthorchis caninus*, the liver fluke of the Indian pariah dog. *Ann. Trop. Med. Parasit.* 6, 117–128.
1912. (With H. B. FANTHAM.) The measurement of *T. rhodesiense*. *Proc. Roy. Soc. B.* 85, 223–234; *Ann. Trop. Med. Parasit.* 6, 131–142.
1912. (With H. B. FANTHAM.) *Trypanosoma rhodesiense*. *J. Path. Bact.* 16, 407.
1912. (With H. B. FANTHAM.) *Trypanosoma rhodesiense*. *Brit. Med. J.* (2 November).
1913. (With H. B. FANTHAM.) Further measurements of *Trypanosoma rhodesiense* and *T. gambiense*. *Ann. Trop. Med. Parasit.* 1, 27–39.
1913. Studies in blackwater fever. I. Statistical. *Ann. Trop. Med. Parasit.* 7, 479–507.
1913. (With B. BLACKLOCK.) On the non-identity of *Trypanosoma brucei* Plimmer and Bradford 1899 with the trypanosome of the same name from the Uganda ox. *Proc. Roy. Soc. B.* 86, 187.
1914. A new malaria parasite of man. *Proc. Roy. Soc. B.* 87, 375–377; *Ann. Trop. Med. Parasit.* 8, 119–128.
1914. *Sleeping Sickness Commission. Minutes of evidence, etc.* H.M. Stationery Office, p. 263.
1914. Studies in blackwater fever. II. A schedule for recording cases of blackwater fever. *Ann. Trop. Med. Parasit.* 8, 639–640.
1915. On the peculiar morphological appearance of a malaria parasite. *Ann. Trop. Med. Parasit.* 9, 169–172.
1915. (With W. STOTT.) Studies in blackwater fever. III. The relationship of quinine to blackwater fever. *Ann. Trop. Med. Parasit.* 9, 201–212.
1915. Studies in blackwater fever. IV. Note on a case of quartan malaria associated with blackwater fever. *Ann. Trop. Med. Parasit.* 9, 429–433.
1915. Studies in blackwater fever. V. The duration of haemoglobinuria. *Ann. Trop. Med. Parasit.* 9, 429–433.
1915. (With EMVYS-ROBERTS). Banana debris in faeces simulating tape-worm segments. *J. Path. Bact.* 19, 486.
1916. (With H. B. FANTHAM and F. V. THEOBALD.) *The animal parasites of man*. London: John Bale Sons and Danielsson.
1917. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE and C. F. COOPER.) Studies in the treatment of malaria. I. Intravenous injection of tartar emetic. *Ann. Trop. Med. Parasit.* 11, 91–111.
1917. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE and C. F. COOPER.) Studies in the treatment of malaria. II. Intramuscular injections of quinine bihydrochloride in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 113–126.

1917. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE and C. F. COOPER.) Studies in the treatment of malaria. III. Intravenous injections of quinine bihydrochloride. *Ann. Trop. Med. Parasit.* 11, 149–164.
1917. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE and C. F. COOPER.) Studies in the treatment of malaria. IV. Intramuscular injections of amylopsin and trypsin in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 165–171.
1917. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. V. Intramuscular injections of quinine alkaloid in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 173–182.
1917. (With D. L. MACKINNON.) A preliminary statement on the treatment of *Entamoeba histolytica* infections by 'Alcresta ipecac'. *Ann. Trop. Med. Parasit.* 10, 397–410.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. VI. Oral administration of quinine for two consecutive days only in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 283–307.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. VII. Oral administration of quinine sulphate daily over prolonged periods in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 309–330.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. VIII. Oral administration of quinine sulphate for two consecutive days weekly over prolonged periods in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 331–358.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. IX. A comparison of the results of interrupted and continuous quinine administration. *Ann. Trop. Med. Parasit.* 11, 359–363.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. X. Oral administration of quinine sulphate grains 120 on two consecutive days only in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 417–419.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XI. Oral administration of quinine sulphate grains 90 on two consecutive days weekly over a period of three weeks in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 421–423.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XII. At what time after cessation of quinine treatment do relapses occur in simple tertian malaria. *Ann. Trop. Med. Parasit.* 11, 425–441.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XIII. Oral administration of quinine sulphate grains 90 on two consecutive days only in simple tertian malaria (second series). *Ann. Trop. Med. Parasit.* 12, 71–77.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XIV. Quinine bihydrochloride grains 30 intramuscularly and quinine hydrochloride grains 30 orally daily for 12 days in simple tertian malaria. *Ann. Trop. Med. Parasit.* 12, 197–200.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XV. A factor hitherto overlooked in the estimation of the curative value of treatments of malaria. *Ann. Trop. Med. Parasit.* 12, 201–210.
1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XVI. Intravenous injections of novarsenobillon in simple tertian malaria. *Ann. Trop. Med. Parasit.* 12, 211–216.

1918. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XVII. Oral administration of quinotoxin for two consecutive days only in simple tertian malaria. *Ann. Trop. Med. Parasit.* 12, 217-222.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XVIII. A comparison of the value of continuous and interrupted quinine administration in simple tertian malaria (second communication). *Ann. Trop. Med. Parasit.* 12, 303-338.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XIX. Intravenous injections of disodoluargol in simple tertian malaria. *Ann. Trop. Med. Parasit.* 12, 339-343.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XX. Intramuscular injections of colossal manganese in simple tertian malaria. *Ann. Trop. Med. Parasit.* 12, 345-347.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XXI. Arsenic in simple tertian malaria. *Ann. Trop. Med. Parasit.* 12, 371-402.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XXII. Intramuscular injections of quinine bihydrochloride grains 15 on each of two consecutive days only in malignant tertian malaria. *Ann. Trop. Med. Parasit.* 13, 63-67.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XXIII. Oral administration of quinine sulphate grains 30 on each of two consecutive days weekly over a period of five weeks in malignant tertian malaria. *Ann. Trop. Med. Parasit.* 13, 69-72.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XXIV. The disappearance of crescents under quinine treatment. *Ann. Trop. med. Parasit.* 13, 73-74.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XXV. Arsenic in malignant tertian malaria. *Ann. Trop. Med. Parasit.* 13, 75-81.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XXVI. The action of arsenic and of quinine on quartan malaria. *Ann. Trop. Med. Parasit.* 13, 97-99.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Studies in the treatment of malaria. XXVII. Intravenous injections of novarsenobillon and intramuscular injections of quinine bihydrochloride in simple tertian malaria. *Ann. Trop. Med. Parasit.* 13, 107-108.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE and W. R. O'FARRELL.) Studies in the treatment of malaria. XXVIII. Quinine hydrochloride in simple tertian malaria. *Ann. Trop. Med. Parasit.* 13, 117-118.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE and W. R. O'FARRELL.) Studies in the treatment of malaria. XXIX. Oral administration of liquor arsenicalis minims 30 daily for 16 days with quinine hydrochloride grains 15 intramuscularly on the first and second, eighth and ninth, fifteenth and sixteenth day in simple tertian malaria. *Ann. Trop. Med. Parasit.* 13, 119-124.
1919. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE and W. R. O'FARRELL.) Studies in the treatment of malaria. XXX. At what time after cessation of quinine treatment do relapses occur in simple tertian malaria (second communication). *Ann. Trop. Med. Parasit.* 13, 125-131.
1921. Some statistics of filariasis. *Ann. Trop. Med. Parasit.* 14, 341-354.
1921. (With W. YORKE, B. BLACKLOCK and J. W. S. MACFIE.) Studies in the treatment of malaria. XXXI. The time of onset of the paroxysms in simple tertian malaria. *Ann. Trop. Med. Parasit.* 14, 365-369.

1921. (With W. YORKE, B. BLACKLOCK, J. W. S. MACFIE, C. F. COOPER and H. F. CARTER.) Have differential leucocyte counts any value? *Ann. Trop. Med. Parasit.* **14**, 371–388.
1921. (With S. ADLER.) A case of suspected leprosy. *Ann. Trop. Med. Parasit.* **15**, 173–176.
1921. Malaria on a Venezuelan oilfield. *Ann. Trop. Med. Parasit.* **15**, 435–444.
1922. Undulant fever in the naval, military and civilian populations of Malta. *Ann. Trop. Med. Parasit.* **16**, 11–20.
1922. The incidence of a disease in population groups, the number of people in which is known or unknown. *Ann. Trop. Med. Parasit.* **16**, 199–205.
1922. A new malaria parasite of man. *Ann. Trop. Med. Parasit.* **16**, 383–388.
1922. (With W. YORKE.) A case of sleeping sickness (*T. gambiense*) treated by 'Bayer 205'. *Ann. Trop. Med. Parasit.* **16**, 421–424.
1923. Studies in the treatment of malaria. XXXII. Summary of studies I–XXXI. *Ann. Trop. Med. Parasit.* **17**, 303–316.
1924. Some morphological features of *Plasmodium falciparum*. *Ann. Trop. Med. Parasit.* **18**, 33–35.
1924. (With R. M. GORDON.) The relative number of male and female crescents. *Ann. Trop. Med. Parasit.* **18**, 55–59.
1924. Duration of infection in malaria. *Ann. Trop. Med. Parasit.* **18**, 127.
1924. (With R. M. GORDON.) The crescent and the red cell. *Ann. Trop. Med. Parasit.* **18**, 207–210.
1924. A case of sleeping sickness (*T. gambiense*) treated with 'Bayer 205'. *Ann. Trop. Med. Parasit.* **18**, 413.
1924. Blackwater fever. *Proc. Internat. Conf. on Health Problems in Trop. America*, 121–128.
1925. Ceylon: parasite and spleen rates, parasite ratios. *Ann. Trop. Med. Parasit.* **19**, 139.
1925. The Golubacser fly. *Ann. Trop. Med. Parasit.* **19**, 262–263.
1925. *Filaria medinensis*. *Ann. Trop. Med. Parasit.* **19**, 465–466.
1927. (With D. U. OWEN.) *Plasmodium ovale*. *Ann. Trop. Med. Parasit.* **21**, 293–302.
1927. The distribution of blackwater fever in Europe. *Ann. Trop. Med. Parasit.* **21**, 467–478.
1927. The haemoglobinureas. *Trans. R. Soc. Trop. Med. Hyg.* **20**, 401–411.
1927. The functions of the spleen. *Trans. R. Soc. Trop. Med. Hyg.* **21**, 161–184.
1928. The distribution of blackwater fever in South-West Asia. *Ann. Trop. Med. Parasit.* **22**, 53–58.
1928. The distribution of blackwater fever in Burma and the Far East. *Ann. Trop. Med. Parasit.* **22**, 179–199.
1929. The distribution of blackwater fever in Africa. *Ann. Trop. Med. Parasit.* **23**, 67–102.
1929. The distribution of blackwater fever in North America. *Ann. Trop. Med. Parasit.* **23**, 451–481.
1933. The distribution of blackwater fever in Central America. *Ann. Trop. Med. Parasit.* **27**, 283–307.
1933. The life of Sir Patrick Manson. *Dict. Nat. Biography*.
1934. The distribution of blackwater fever (summary). *Ann. Trop. Med. Parasit.* **28**, 37–40.
1937. *Blackwater fever*. Liverpool: University Press. London: Hodder & Stoughton Ltd.

REFERENCES TO OTHER WRITERS

1914. E. L. PERRY. Endemic malaria of the Jeypore Hill Tracts of the Madras Presidency. *Indian J. Med. Res.* **2**, 456–491.
1924. S. R. CHRISTOPHERS. The mechanism of immunity against malaria in communities living under hyperendemic conditions. *Indian J. Med. Res.* **12**, 276.

1932. S. P. JAMES, W. D. NICOL and P. G. SHUTE. *Plasmodium ovale* Stephens: passage of the parasite through mosquitoes and successful transmission by their bite. *Ann. Trop. Med. Parasit.* 26, 139-145.
1933. S. P. JAMES, W. D. NICOL and P. G. SHUTE. *Plasmodium ovale* Stephens 1922. *Parasitology*, 25, 87-95.
1939. J. A. SINTON, E. L. HUTTON and P. G. SHUTE. Studies of infections with *Plasmodium ovale*: natural resistance to *ovale* infections. *Trans. R. Soc. Trop. Med. Hyg.* 32, 751-762.

